INFILCO

Bulletin 1825

the ACCELATOR®

treating plant

"ACCELATOR"

treating plant

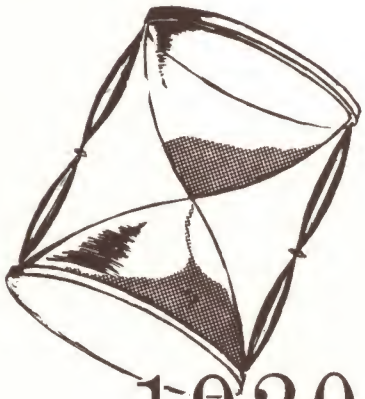
The more than 1900 "ACCELATOR" treating units now in service daily demonstrate that this equipment is something more than a new mechanical device. In the operating results of these hundreds of installations is found the proof that the "ACCELATOR" (AK-SEL'-A-TOR) unit is the outstanding development of the 20th century in the field of water treatment.

For a proper understanding of the reasons for the remarkable performance records established by the "ACCELATOR" treating plants, a careful study of the chemical and hydraulic principles involved is required.

An attempt is made herein to delineate those principles much in the manner of a scientific report. Obviously, any such report would not be complete without some references to alternative practices, old and new. This method of exposition, where it is used, is not intended to detract from the merit of the competitive processes of reputable manufacturers, but rather to illustrate and emphasize points of particular importance.

In addition, these pages contain a resume of the experience gained in the design and operation of many hundreds of "ACCELATOR" treating units now in service treating all types of water for a variety of purposes in many parts of the world.

Historical Development . .



The "ACCELATOR" treating plant is the result of research started more than 35 years ago by INFILCO's technical staff. It represents a revolutionary advance in the art of water treatment. Treating reagents are applied in a new way. The reactions take place under new conditions. Treated and clarified water is produced to new high standards. Sludge is automatically withdrawn in a new and effective manner. In short, its operating principles are entirely new and distinct from usual past and current practice.

Practically all research in the field of lime-soda water softening has had as its objective improvements in the method of chemical application and removal of the products of reaction, with a view to increasing efficiency and chemical economy and to reducing the time and space required.

In the beginning of the art, it was common practice to add precipitating reagents to the water in a tank and to rely on the mixing incident to filling, and a generous increment of time, to bring about the desired results. General dissatisfaction with those results, and with the excessive quantities of chemicals required, led to improvements along the lines of mixing, coagulation, and settling.

It is reasonably accurate to suppose that the first solid particle resulting from the reaction of treating chemicals and water is of colloidal size; at any rate, very small indeed and not of sufficient mass to settle in any reasonable time. If the water containing such minute reaction products were turned out into settling basins without further preparation, extremely large and expensive basins would be required.

Thus, there came about the development of flash mixing equipment for rapid and thorough dispersal of treating chemicals through the raw water, followed by a separate coagulation or slow mixing basin for preparing the precipitates for more rapid settling. It became standard practice to design water treating plants on the basis of separate mixing, coagulating, and settling basins, usually allowing five minutes for mixing, thirty minutes for coagulation, and four to six hours for settling.

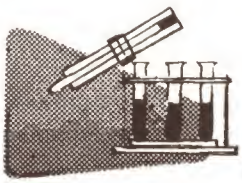
Improvements in these slow-rate types of water treating plants reached their zenith in the late 1930's, at which time they began to be replaced by the modern high-rate treating plants of which the "ACCELATOR" unit was the forerunner. In fact, they have largely disappeared from the plans being prepared today because of the smaller space requirement, lower construction cost, greater chemical economy, and superior results obtainable with the new designs.

Those manufacturers of mixing and coagulating equipment, as used in the early designs, who had research facilities and talent began to experiment with other ways and means of hastening chemical reactions and improving treatment results.

About 1920 our engineers discovered an advantage in taking the sludge out of the bottom of a slow rate basin and returning it to be mixed with the influent. This was based on a fundamental principle of physical chemistry that supersaturation in a liquid is minimized by contact with a solid phase, such as the previously formed precipitates that were returned as sludge. Much of this benefit was lost, however, because the process of collecting and pumping the old sludge resulted in breaking up the particles so that they did not settle readily a second time.

An improvement was made about 1925 when INFILCO designed an experimental plant consisting of an inverted conical settling zone within a circular mixing zone. Water and chemicals were introduced in the lower mixing zone. The precipitates were allowed to settle out in the conical section, from where the sludge returned by gravity to the

mixing zone. In the light of today's knowledge this was a crude device but it overcame the disadvantage of pumping the sludge, and it proved to be an important step in the right direction.



1932

About 1932, as experimentation continued, our engineers noted that the greatest benefit could be obtained when the sludge or slurry was actively recirculated with the treating chemicals. It was then that the full value of the addition of raw water to a chemically impregnated slurry of previously formed precipitates was realized and that the benefits could be more fully stated.

There occurs an enormous acceleration in the rate of separation of the newly formed substances from their state of supersaturation. A state of equilibrium under these new conditions is reached within a few seconds instead of minutes or hours. Therefore the solids do not precipitate as new small particles, molecule by molecule, that have to be gathered together to form a particle large enough to settle out; rather, the greater portion of them deposit by accretion on the particles already present in the slurry so that these particles grow in size.

For example, with this method of adding raw water to a slurry, calcium carbonate is precipitated in crystalline form where softening is involved. The crystalline nature of the precipitate makes the particles relatively hard and stable and thus increases their specific gravity. Therefore, they are not readily subject to disintegration, and they are in such a condition that clear treated water is readily separated from the slurry. In addition, the crystalline form of the calcium carbonate is a distinct advantage in accelerating the separation of such solids from the super-saturated solution.

1936

From those observations was developed the recirculating slurry feature which characterizes the "ACCELATOR" treating plant; and the first full-scale "ACCELATOR" treating plant for softening a municipal water supply was placed in successful operation in 1936.

Many important changes and refinements have been made in the intervening years, but that date marked the beginning of the trend in plant design from the slow-rate to the modern high-rate plants which have opened up new fields and produced benefits not considered possible theretofore.

Figure 1. "ACCELATOR" units at the U. S. Sugar Corp., Clewiston, Florida.

Operation Features . . . .

The "ACCELATOR" treating unit replaces, in a single basin, the previous multiple steps of mixing, coagulation, and sedimentation. It occupies a space that is but a fraction of that required for the slow-rate plant at its highest stage of development. The "ACCELATOR" unit is not merely a departure from slow-rate plant design. Instead, it is based on and utilizes an entirely new operating principle, as will be seen from the material which follows.

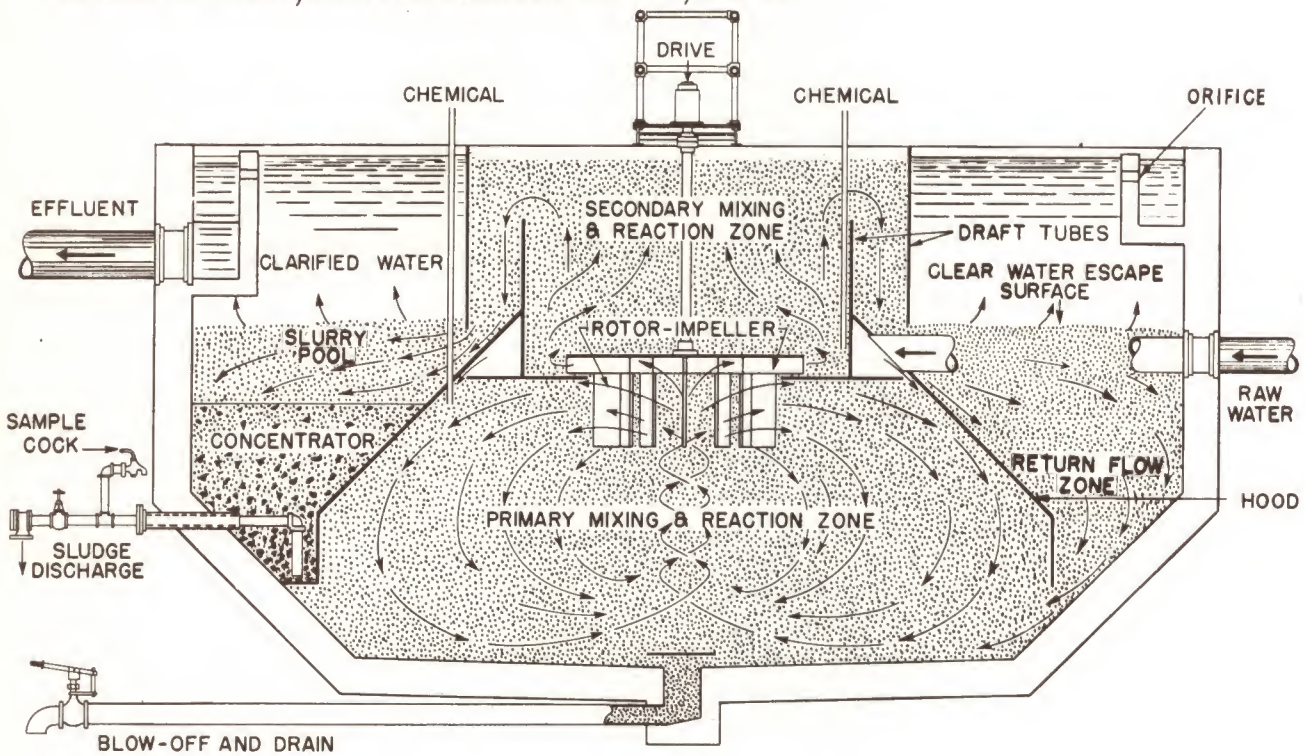


Figure 2
"ACCELATOR" treating plant

The "ACCELATOR" unit (Figure 2) includes a basin in which is contained:

- A raw water inlet and distribution duct
- A primary mixing and reaction zone
- Two concentric draft tubes which form the secondary mixing and reaction zone
- A rotor-impeller for mixing and pumping, driven by a motorized reducer
- An effluent launder system
- Concentrators to accumulate and remove excess slurry

The first distinctive feature of the "ACCELATOR" unit is that chemicals are introduced into the reaction zone so that chemical reactions take place in the presence of a slurry of previously formed precipitates. Under these conditions, precipitation takes place on the surface of the old particles and the resulting flocculent or granular product is almost immediately ready for separation. The formation of finely divided reaction products, which results when chemicals are added to the water prior to slurry contact, and the necessity for securing subsequent coagulation and agglomeration is largely, if not entirely, eliminated.

From the primary reaction zone the entering raw water plus two to four volumes of recirculated slurry pass into the secondary mixing and reaction zone. Here, continued slurry contact brings the treatment reactions to equilibrium before discharge into the outer portion of the "ACCELATOR" basin for solids separation.

Leaving the secondary reaction zone, or outer draft tube, the slurry is discharged outwardly and downwardly onto the surface of a downwardly moving slurry pool. All the slurry is in controlled, directional motion—outward and downward—and from it a volume of treated water is displaced upwardly by an equal volume of incoming raw water. The remaining two to four volumes of circulating slurry are drawn back to the primary mixing zone by the rotor-impeller.

This feature of directed flow and dynamic separation of the treated water from a moving stream or current of circulating slurry, in a direction approximately at right angles to the main slurry flow, is the second distinctive operating principle of the "ACCELATOR" treating plant.

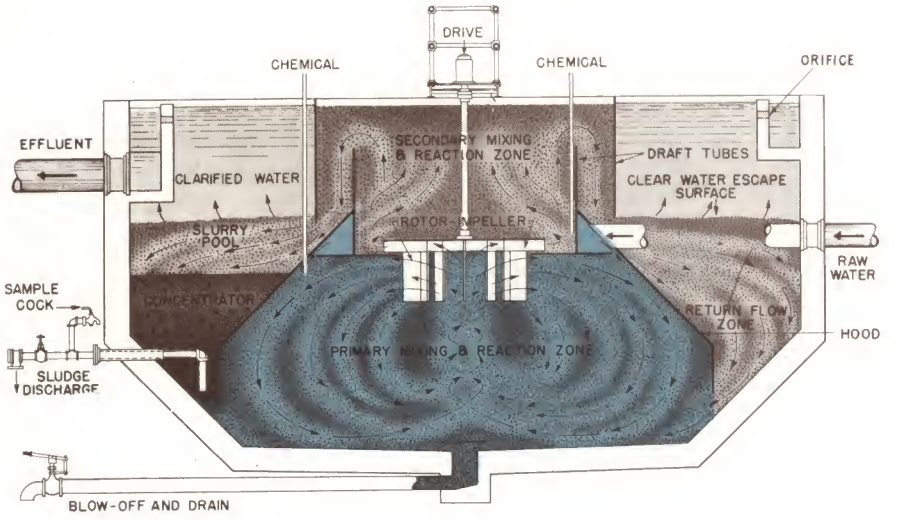
Thus, in the "ACCELATOR" unit the treated water does not filter upward through a suspension of sludge of gradually decreasing particle size, but rather it separates from the top of a downward moving pool of uniformly sized slurry. In this way, several limitations inherent in other high-rate treating units are avoided. For instance, in the "ACCELATOR" unit the slurry pool level is maintained constant and it is independent of the throughput. Small flows have just as much contact with the slurry as large flows.

Furthermore, the treated water take-off rate in the "ACCELATOR" unit is not limited by the upward flow through a sludge suspension which would impose a very definite limit on the maximum possible rise rate. Since the treated water separates at the surface of the downwardly-moving solids suspension, the maximum rise rate is only limited by the settling velocity of the individual well-flocculated particles. This settling velocity is always appreciably greater than the settling velocity of a thick suspension of these particles. Advantage is taken of this well-known physical principle in order to obtain faster separation of the solids from the clear water.

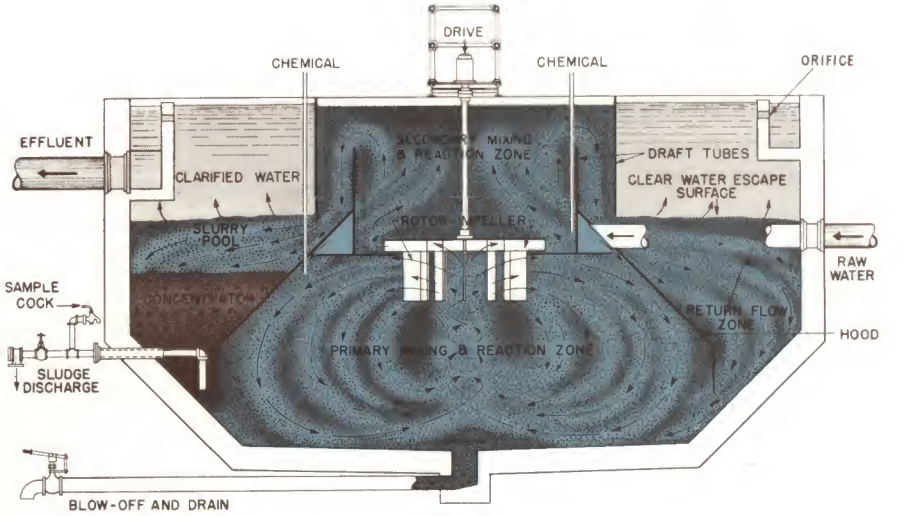
The specially designed rotor-impeller in the "ACCELATOR" unit produces a powerful hydraulic action in the primary mixing and reaction zone. Incoming water, chemicals, and slurry are rapidly mixed so that the settling out of solids on the bottom of the tank is prevented. Because of its unique design, the rotor-impeller moves large quantities of water at a relatively low velocity, thus avoiding breaking up of the floc. Slurry circulation by the impeller is under positive control and may be adjusted in accordance with the requirements of any particular water.

Slurry concentration is kept at a fairly high value in order to provide the maximum amount of surface contact in the reaction zone. In order to keep the slurry concentration at the desired value, the excess solids are allowed to settle and thicken in the hopper-like concentrators. Here, the thickened sludge is periodically and automatically drawn off by a timer-actuated valve. The concentrators are sized for the maximum amount of solids produced by the treatment in the "ACCELATOR" unit.

the ABC's . . . . . .



A. The introduction of chemicals and raw water to the mixing and reaction zone so that reactions take place in the presence of previously formed solids.

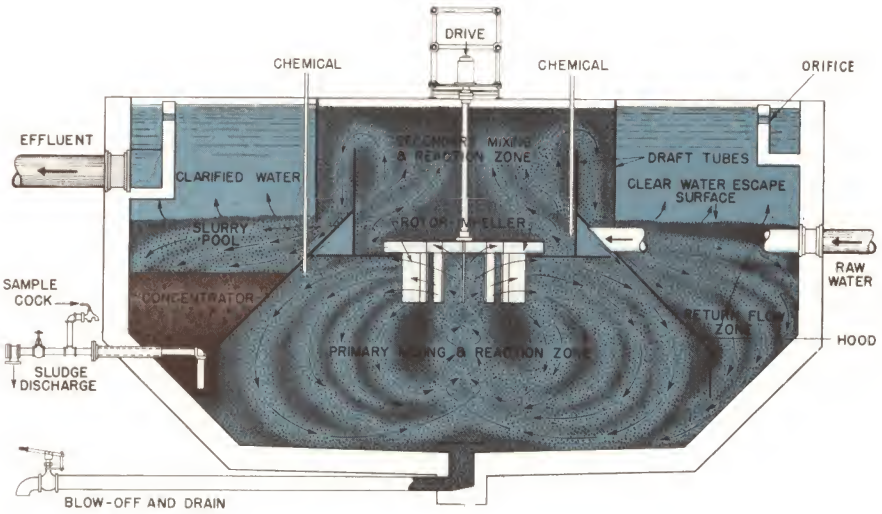


B. Controlled recirculation of slurry—several volumes to one volume of raw water — with positive return of solids from the separation zone to the primary mixing and reaction zone.

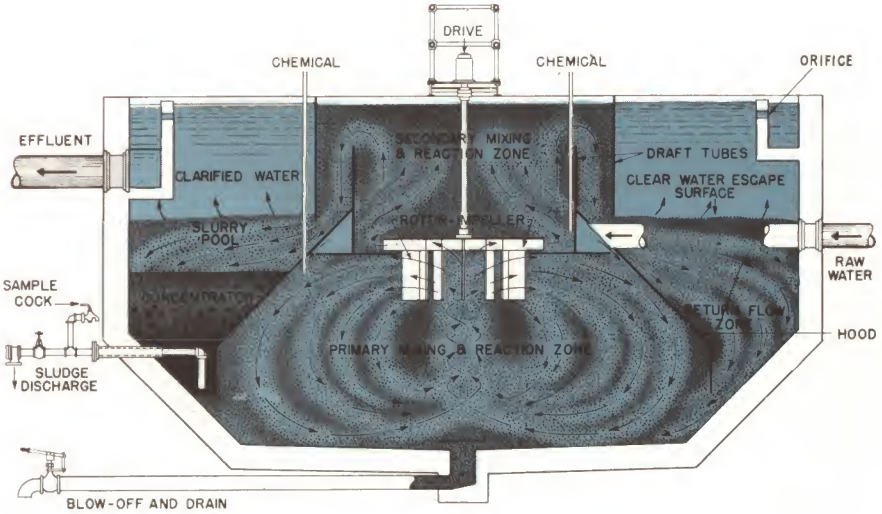
of the "ACCELATOR"

Treating Plant

C. Dynamic high-rate separation of a volume of thoroughly treated and clear water from the slurry return-flow zone by displacement by a volume of raw water.



D. Continuous concentration and automatic withdrawal of excess solids in properly designed and located concentrators.



Distinguishing Characteristics
of the "ACCELATOR"
Treating Plant

Certain characteristics of the "ACCELATOR" treating plant require elaboration and emphasis for accurate understanding. It will be helpful to draw a distinction between the terms "sludge" and "slurry"

"Sludge" defines the solid particles which have settled from water undergoing treatment, or are in the process of settling, whether they be products of chemical reactions or coagulated turbidity or a combination of both. It is this same material which gives the class name "sludge blanket" to certain types of high-rate treating plants today.

In the "ACCELATOR" unit, the reaction products or coagulated turbidities which have been chemically impregnated are referred to as "slurry" to denote that they constitute a live, moving body which is recirculated at several times the through-put rate to do its work time and time again. Only when the excess solids have been withdrawn into the concentrators have they completed their work and become "sludge".

In the "sludge blanket" types of treating plants it is obvious that, as reported by the manufacturers, the water percolates upward through a suspension of sludge, the height to which that sludge will rise being determined by the upward water velocity and the particle size. That height will fluctuate widely with varying through-put rates.

In the "ACCELATOR" unit, the upper level of the slurry pool is *independent* of the through-put rate. The action is the same from its rated capacity down to zero flow, so long as the rotor-impeller is running. The slurry is recirculated under control, and its path is *downward* in the zone of clear water separation. Therefore, the clear water separating rate in the "ACCELATOR" unit is not limited to the settling rate of the sludge mass as in the "sludge blanket" types of plants. That is why smaller basins for a given capacity can be used in the "ACCELATOR" treating plant.

It is the characteristic of dynamic separation which sharply differentiates the "ACCELATOR" treating plant from the quiescent or passive nature of settling or percolation found in other treating equipment.

Since the concentration of slurry is essentially uniform throughout the primary and secondary mixing and reaction zones, it is a simple matter to check the operation of the "ACCELATOR" treating plant. A slurry sample taken from the top of the secondary mixing zone, always readily acessible, is representative of a sample taken at any other point in the slurry zone, as contrasted with the sludge blanket units in which the concentration varies with the depth and through-put rate. Because the adjustment of chemical dosages and sludge discharge rates, important in the operation of any high-rate treating plant, depends to some extent upon the collection and evaluation of uniform, representative slurry samples, the ease with which this can be done in the "ACCELATOR" unit makes its advantage apparent.

If order of addition of chemicals is important, they may be applied at any of three points, which is frequently an advantage for waters of different character. They may be applied in the raw water inlet pipe; they may be applied in the primary mixing zone; or they may be applied in the secondary mixing zone. One or more chemicals may be applied at the same point or they may be applied in series, as, for example, when activated silica is used in clarification or color removal applications.

Because of the different character of the "ACCELATOR" precipitates, a comparatively simple and highly effective method is used for solids removal. Where batch washing out of tanks, manifold blow-off systems, or sludge scraping devices are employed in other methods, the "ACCELATOR" unit uses, instead, concentrating compartments in which the readily settleable solids are gathered and concentrated before removal. The solids in the slur-

ry are only allowed to settle and thicken after they enter the concentrators. There is no settling of solids in any other part of the "ACCELATOR" basin. The design of the concentrators is such that a minimum of treated water is wasted and a positive control of the solids-balance of the system is maintained. The head of water in the basin is generally used to cause the solids to flow from the concentrator, although in some instances sludge pumps may be used.

Additional Advantages

Not the least among the advantages of the "ACCELATOR" treating plant are those of the relative space requirement and lower construction costs, made obvious by Fig. 3. Because of its smaller size, an "ACCELATOR" installation will require less concrete, less excavation, less piling where such is necessary, less covering when it is desirable to protect the plant from the elements.

Because the "ACCELATOR" treating plant consists of one unit instead of three, it requires less power and less maintenance. There are fewer mechanical parts, and there are no underwater bearings. Actually, there is a complete absence of parts which rub against each other, except in the speed reducer.

Because of the recirculating slurry feature, the "ACCELATOR" treating plant is less subject to plant upsets resulting from rapid changes in the raw water characteristics. That body of slurry acts as a buffer to iron out such changes.

Sludge is handled easily and automatically. Routine draining and cleaning of settling basins is done away with. Instead, a highly concentrated sludge, with a minimum wastage of water, is withdrawn automatically and conveniently. There is no place within the "ACCELATOR" basin itself, other than the concentrators, for the sludge to collect and be a nuisance.

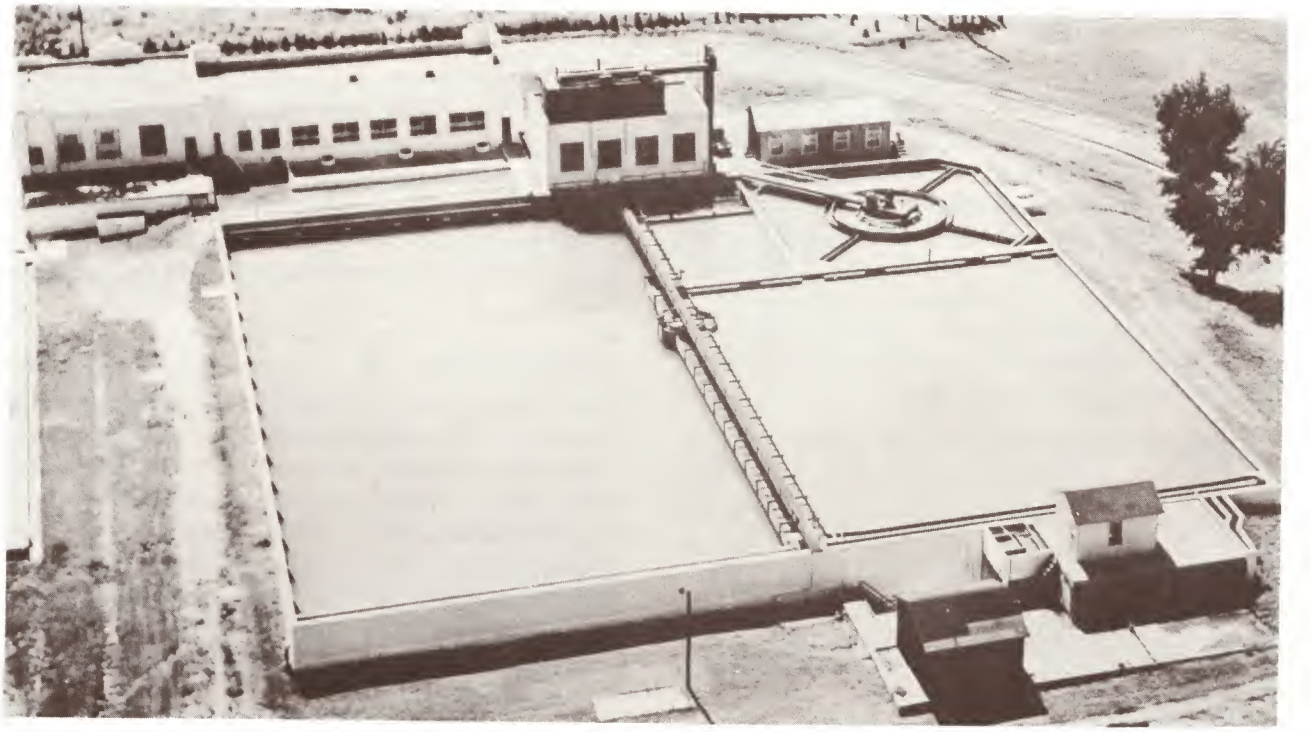
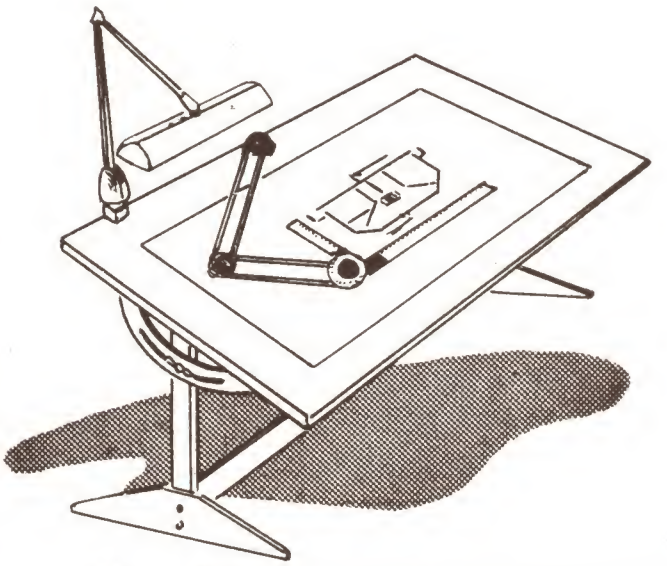


Figure 3. This "ACCELATOR" unit, 70 feet square, in upper right of photo, installed in much less space, treats 12 M.G.D. as compared to 9 M.G.D. treated in basin requiring much more space.

Design Considerations



Area of Basins: "ACCELATOR" units for most treating applications are designed to operate with rising rates in the separation zone of the basin, consistent with the treatment process involved. When handling waters of moderate to high turbidities, or where the bulk of the precipitate is $CaCo_3$, rise rates of 2.25 to 2.5 g.p.m. per sq. ft. are entirely practical. On the other hand, when treating low turbidity waters for clarification and/or color removal, or where a considerable portion of the precipitate is $Mg(OH)_2$, lower rise rates are employed. Other types of equipment commonly use rising rates as low as 0.25 g.p.m. per sq. ft. and there are few, if any, competitive installations operating at rates in excess of 1.5 g.p.m. per sq. ft.

At the same time, rise rates utilized in the "ACCELATOR" treating plant are definitely conservative and leave margins of safety.

Depth of Tanks: As the area increases to provide for increased capacities, the depth of the "ACCELATOR" basin likewise increases. The increase is not, however, proportional to the increase in area and will vary in practice from a minimum of about 10 feet for small units to about 20 feet for 15 M.G.D. plants. Incidentally, a unit of this latter capacity requires a basin only 86 feet in diameter or 77 feet square.

Raw Water Supply: The method of raw water introduction, shown in the functional diagram on Page 6, provides rapid and thorough diffusion of the water into the slurry containing the treating chemicals.

Chemical Supply: The chemicals, such as lime, soda ash, or coagulants, are normally introduced into the primary mixing chamber, though for combination softening and clarifying, or for special applications, the coagulant may be introduced in the secondary zone. Further, a third possible place to add chemicals is in the raw water distribution duct, which may be an advantage in certain instances.

Circulation: Mixing and circulation are provided by a rotor-impeller mounted on a central shaft and driven from above. Circulation has the objective of maintaining a positive and directed flow to fulfill the fundamental requirements of "ACCELATOR" treating plant operation and to maintain clean floor conditions, with a wide margin of safety. Maintenance of this circulation requires a very nominal power input.

Motors are selected with generous factors of safety for long life and reliability. Even with such conservative design, only a 7.5 horsepower motor is required for an 8 M.G.D. "ACCELATOR" unit. The rotor-impeller is designed to provide a complete turn-over of the contents of the primary reaction zone once each minute, and to cause a circulating flow of 3 to 5 times the volume of through-put. Relatively slow shaft speeds are used, the peripheral speed of the rotor being kept between 2 to 4 feet per second. This speed of movement conditions the floc and enhances the desirable properties of the slurry.

Solids Removal: In the design of concentrators in an "ACCELATOR" unit the governing factor is the maximum quantity of solids that the unit will be called upon to handle. Sufficient area and volume are provided in the concentrators to handle the maximum solids with ease. Concentrators which may not be needed at any given time are easily taken from service by opening their hinged bottom gate.

Sludge is discharged from the concentrators through large withdrawal lines having a blow-off valve which operates on a controllable time cycle. In variable rate plants the time cycle is controlled automatically by the same equipment that controls the chemical feed in proportion to raw water flows.

The percentage of time the blow-off valve is open depends upon the quantity of sludge produced and it is easily adjustable to accommodate changes in dosage, raw water characteristics, or flow rate. Sludge is discharged at a high flow rate over a short interval of time, thereby affording a scouring action in the concentrator and providing a flushing action in the lines which is most desirable. The bottom of the concentrator is small—seldom more than 18 inches square. It is interesting to contrast this with the floor areas of settling basins from which solids must be removed.

Launders: The design and location of effluent launders depends upon the size of the treating plant and, to some extent, the character of the water being treated. In general, peripheral launders are used in "ACCELATOR" units up to 1400 g.p.m. capacity. Radial launders are used for all larger plants. Such launders, which are self-supporting, provide scientifically correct take-off of treated and clarified water.

Constant or Variable Rates: "ACCELATOR" treating plants may be operated either at a constant rate or at a variable rate, as operating conditions may require. The "ACCELATOR" unit itself is capable of operating at any rate from zero to the designed capacity, but usually the chemical feeding equipment is not accurate below 10% of normal rate. Equipment is available for automatically proportioning chemical feed to the treating rate within those limits.

Summary: In all respects "ACCELATOR" plant design takes advantage of its remarkable properties which permit small tank area, moderate basin depth, and solids removal confined to small portions of the basin where they cannot interfere with the clarifying function.

Operation

Operation of the "ACCELATOR" treating plant is simple and easily understood, but an understanding of the hydraulic and chemical principles involved is not absolutely necessary, for there are many small installations being operated by personnel having no real comprehension of the fundamentals and yet they are doing a splendid job by following instructions.

The first requisite is proper chemical dosages, and a regular schedule of jar tests is a great aid to proper and economical operation, especially on surface supplies of variable characteristics. Next in importance is a regular check on the treatment. Solids will accumulate automatically and slurry can be developed and regulated by determining periodically the amount of solids in the circulating slurry by means of a simple five-minute settling test. With rapidly varying or "flashy" streams, more frequent checking may be necessary, but ordinarily one or two determinations a day are sufficient.

Only one other adjustment is necessary, and this occurs only on clarification units. "ACCELATOR" units for this service are equipped with variable speed drives to meet the variable floc character imposed by fluctuations in suspended solids, chemical characteristics, and water temperature. The speed adjustment follows one simple rule—the highest possible speed is best and should be used.

These three operating requirements: (1) proper chemical treatment, (2) regulation of slurry concentration within prescribed limits, and (3) highest possible circulation, are all that are required to obtain typically excellent "ACCELATOR" treating plant performance. Everyone interested in modern water treatment should take the time to look at "ACCELATOR" units in operation, study the operating data, and make a fair evaluation of this most modern, high-rate water treating plant.

It is remarkable to note that for many applications it is not necessary to filter water treated in "ACCELATOR" plants. This is true when the water is to be used for cooling, for certain grades of pulp, etc., where the low turbidity of the "ACCELATOR" unit effluent is well below minimum requirements. The treated water turbidity is ordinarily on the order of 2 to 5 p.p.m., and it is guaranteed not to exceed an average of 10 p.p.m. when the raw water turbidity does not exceed 5,000 p.p.m.

Applications . . .

The "ACCELATOR" treating plant is applicable to an amazingly wide variety of liquid treating problems involving the precipitation and removal of solid matters. Fundamentally the design and operation of the "ACCELATOR" treating plant are much the same for all problems. The variations that occur are in the kinds and quantities of chemicals used, and rise rate employed, depending on the characteristics of the liquid to be treated, and the results that are desired.

Many times it is advisable, and economical, to provide for the feeding of activated silica for those applications involving clarification or color removal. Technical information regarding the use of activated silica, as well as all other chemicals, is available upon request.

Obviously, the "ACCELATOR" treating plant will be used most commonly for softening, clarification or stabilization of surface or ground water supplies for municipal or industrial use. There are a number of other specific applications, however, in which the "ACCELATOR" treating plant has proved to be a profitable investment.

Figure 4. Municipal "ACCELATOR" installation, City of Canton, Illinois.

Municipal Water Supply

The "ACCELATOR" treating plant is very widely used by progressive engineers when designing and constructing modern water conditioning plants. By the end of 1954 there were already over 300 municipal "ACCELATOR" treating plant installations, in single or multiple units, ranging in capacity from 72,000 G.P.D. to 75,000,000 G.P.D.

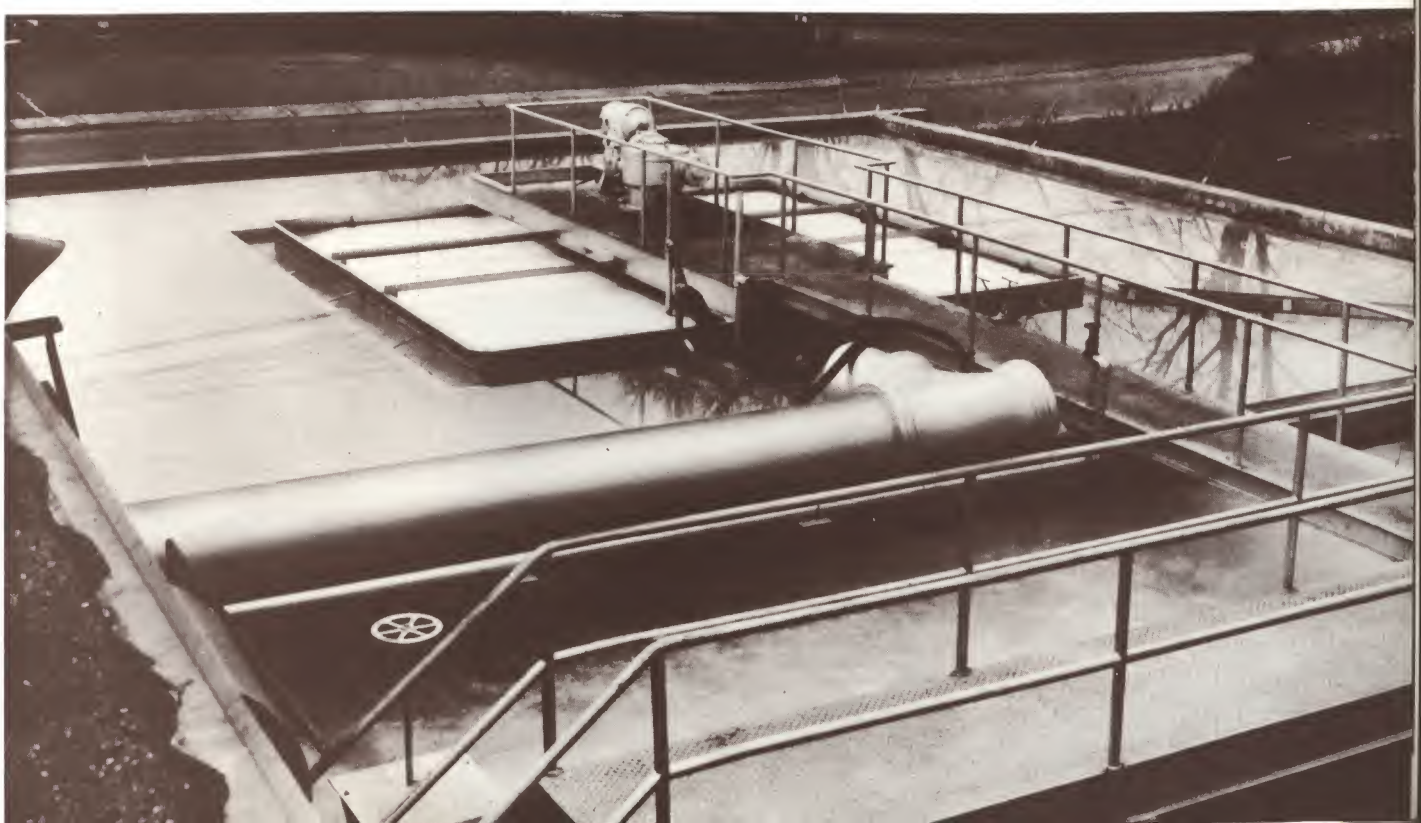
Municipal users of the "ACCELATOR" treating plant benefit from all its advantages of flexibility, uniformly good effluent, small space, minimum construction cost, ease of operation, chemical economy, etc. In addition, tests have proved that the "ACCELATOR" unit, because of the slurry contact, is highly efficient in the removal of bacteria. Such tests, independently conducted, have demonstrated consistent removal of over 99% of the bacteria. This means substantial savings in chlorine.

Suggested specifications and typical layouts will be found elsewhere in this Bulletin.

TYPICAL INSTALLATIONS

City of	gpm
• *Sao Paulo, Brazil, S. A.*	52,500
• *Casablanca, Morocco*	24,000
• *Tampa, Florida*	21,000
• *Benton Harbor, Michigan*	11,200
• *Fargo, North Dakota*	9,450
• *Wichita Falls, Texas*	8,750
• *Decatur, Illinois (shown on cover)*	8,400
• *Marion, Indiana*	5,840
• *Lebanon, Oregon*	5,600
• *Coshocton, Ohio*	4,200
• *Gainesville, Florida*	3,500
• *Mitchell, South Dakota*	2,100
• *Falls City, Nebraska*	1,400
• *Marshall, Missouri*	1,400
• *Williams Bay, Wisconsin*	1,400
• *Kelso, Washington*	1,400
• *Canton, Illinois*	1,100
• *Vero Beach, Florida*	1,040
• *Cochrane, Ontario, Canada*	875
• *Williamson, New York*	750

Figure 5. "ACCELATOR" unit of the rectangular type, City of Coshocton, Ohio.



Industrial Water Treatment

Many Industrial Engineers realize that it is better to remove undesirable substances from process water by effective treatment rather than to attempt to modify their processing technique to compensate for the effects of the impurities. Suspended matter, iron and manganese, calcium and magnesium, and organic color are all detrimental to many processes which use water as a carrier or for direct contact with their product.

Steel mills and metal processing plants use water treated in "ACCELATOR" plants for rinsing metal parts after pickling or after plating. Textile and rayon mills need a clean, colorless and soft water, and several have installed "ACCELATOR" plants for clarifying or softening the plant supply. The food and beverage industries have recognized the merits of the "ACCELATOR" treating plant for many years. Canning plants, dairies, milk reconstitution plants, cheese processors, distilleries, breweries and soft drink bottlers are among the more numerous users. There are over 800 "ACCELATOR" units installed in bottling plants alone. Chemical manufacturing plants are also extensive users of the "ACCELATOR" unit for the treatment of process water. For example, one large manufacturing concern has installed seven "ACCELATOR" units in its various plants.

In another application, the "ACCELATOR" treating plant is used for producing a saturated lime water. A concentrated slurry of hydrated lime is maintained in the reaction zones, and, because of the large amount of lime particle surface, a clarified and more completely saturated lime water is produced in an "ACCELATOR" unit having a detention time of about 90 minutes than had been obtained in mixing basins having a detention of 6 hours.

There are doubtless many similar industrial applications which suggest themselves. INFILCO's laboratories and research facilities are available for investigations of promising new applications.

TYPICAL INSTALLATIONS

Name of company	gpm
• *Dow Chemical Co.—Pittsburg, California*	10,000
• *National Petrochemical—Tuscola, Ill.*	7,000
• *Monsanto Chemical Co.—Texas City, Texas*	6,750
• *Baldwin Locomotive Works, Eddystone, Pennsylvania*	6,000
• *Anheuser-Busch, Inc.—St. Louis, Missouri*	4,200
• *National Lead Co.—St. Louis, Missouri*	4,200
• *Bayer Div.–Winthrop Chemical Co.–Rensselaer, N.Y.*	3,500
• *Viscosa Mexicana—Zacapu, Mexico*	3,500
• *Pittsburgh Plate Glass Co.—Crystal City, Mo.*	2,100
• *American Cyanamid Co.—Gloucester, N. J.*	1,750
• *Johns-Manville Co.—Manville, N. J.*	1,500
• *American Thread Co.—Fall River, Mass.*	1,400
• *Thomas Steel Co.—Warren, Ohio*	1,400
• *American Thread Co.—Williamantie, Conn.*	875
• *Personal Products Co.—Milltown, New Jersey*	700
• *Imperial Sugar Co.—Sugerland, Texas*	700

Figure 6. Water clarification at the Wheeling Steel Plant, Yorkville, Ohio is accomplished in this "ACCELATOR" plant.

Boiler Feed Water Treatment

The "ACCELATOR" treating plant is employed for the treatment of boiler feed water in a number of ways, e.g., for lime and soda ash softening; for lime pretreatment for reduction of alkalinity and dissolved solids prior to complete softening by other means such as exchange processes; for removal of turbidity, suspended and organic matter (color) to condition the water for subsequent softening treatment.

For boilers operating at 200 psi G. or less, the "ACCELATOR" treating plant utilizing lime, soda ash and a coagulant as treating reagents, provides, in many instances, a suitably softened water for boiler feed purposes, and for other plant purposes where softened water is required.

TYPICAL INSTALLATIONS

Name of company	gpm
• *Jones & Laughlin—Pittsburgh, Pa.*	4,200
• *Union Electric Co.—St. Louis, Missouri*	3,000
• *Carbide & Carbon Chemical Corp.—Institute, W. Va.*	2,400
• *Carbide & Carbon Chemical Corp.–Texas City, Texas*	2,400
• *Clinton Company—Clinton, Iowa*	2,100
• *Allan Wood Steel Co.—Conshohocton, Pennsylvania*	1,750
• *Youngstown Sheet & Tube Co.–Indiana Harbor, Ind.*	1,660
• *Solvay Process Co.—No. Baton Rouge, La.*	1,500
• *Rayonier, Inc.—Fernandina, Florida*	1,500
• *Pennsylvania Salt Mfg. Co.—Wyandotte, Michigan*	1,200
• *Acme Steel Company—Riverdale, Illinois*	833
• *Ohio Edison Co.—Springfield, Ohio*	600
• *General Tire & Rubber Co.—Akron, Ohio*	450
• *Republic Steel Co.—Alabama City, Alabama*	400
• *El Paso Natural Gas Co.—Jal, New Mexico*	250

For higher pressure boilers, where feed water quality is more exacting, the "ACCELATOR" treating plant effluent requires further treatment to remove the moderate amount of hardness remaining in the water. Such permanent hardness may be removed, for example, by zeolite softening.

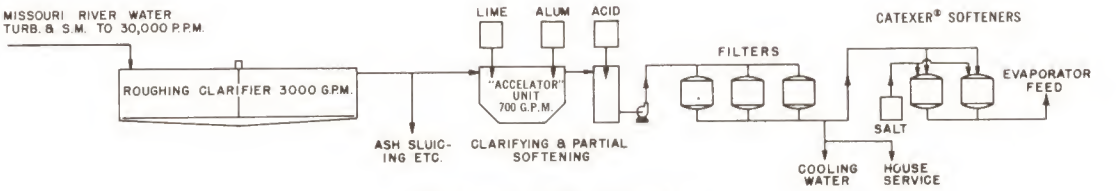
For surface supplies, the "ACCELATOR" unit may be employed for removing turbidity and suspended matter with or without the simultaneous removal of the bulk of the carbonate hardness present where water characteristics permit. The treated and filtered water—now clean and clear and of reduced hardness and alkalinity – is then ready for zeolite softening. Or, the clarified water—now relatively free from suspended solids and organic matter—is suitable for final treatment in a hot process softener or other type of softener.

The pretreatment afforded by the "ACCELATOR" treating plant is, in many instances, necessary to the successful functioning of final treatment steps employed. In other instances, such "ACCELATOR" plant pretreatment affords desirable chemical economies.

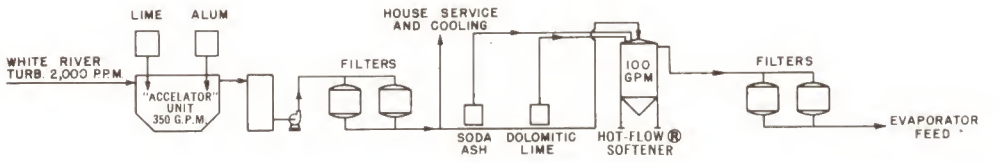
Because the treated water is usually of desirable characteristics for other plant requirements, such as for process work and cooling system make-up, plant-wide benefits may frequently be gained by the installation of an "ACCELATOR" unit to treat all plant water. That portion required for boiler use may be further treated by appropriate means for the conditions to be met.

Figure 7. This "ACCELATOR" softener treats boiler feed water at Rayonier, Inc., Fernandina, Florida.

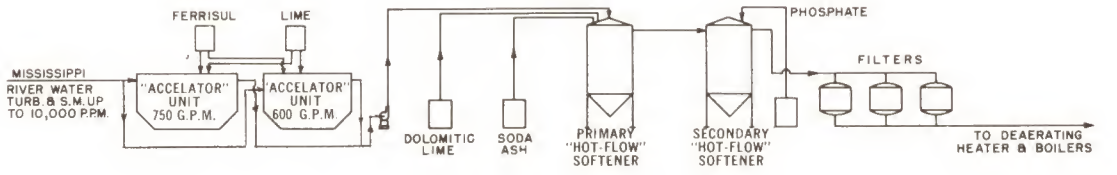
BOILER FEED WATER TREATMENT FLOW DIAGRAMS



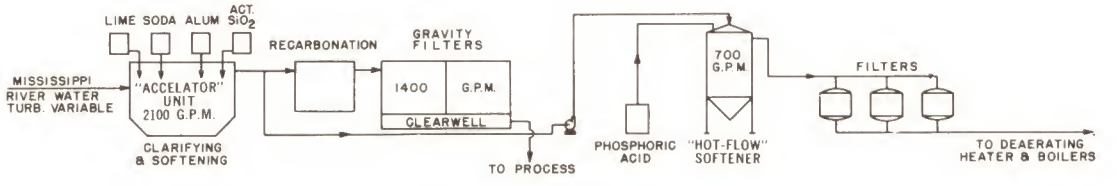
BELLEVUE FLOW DIAGRAM



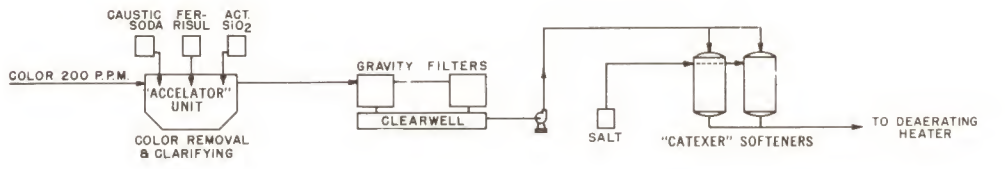
EDWARDSPORT FLOW DIAGRAM



SOLVAY PROCESS FLOW DIAGRAM



CLINTON INDUSTRIES FLOW DIAGRAM



ST. REGIS PAPER FLOW DIAGRAM

Cooling Water Treatment

Make-up of water for cooling systems should be clean and low in carbonate hardness and of sufficiently high pH to keep heat exchange surfaces from fouling with organic growths or scale, or both, and to prevent corrosion.

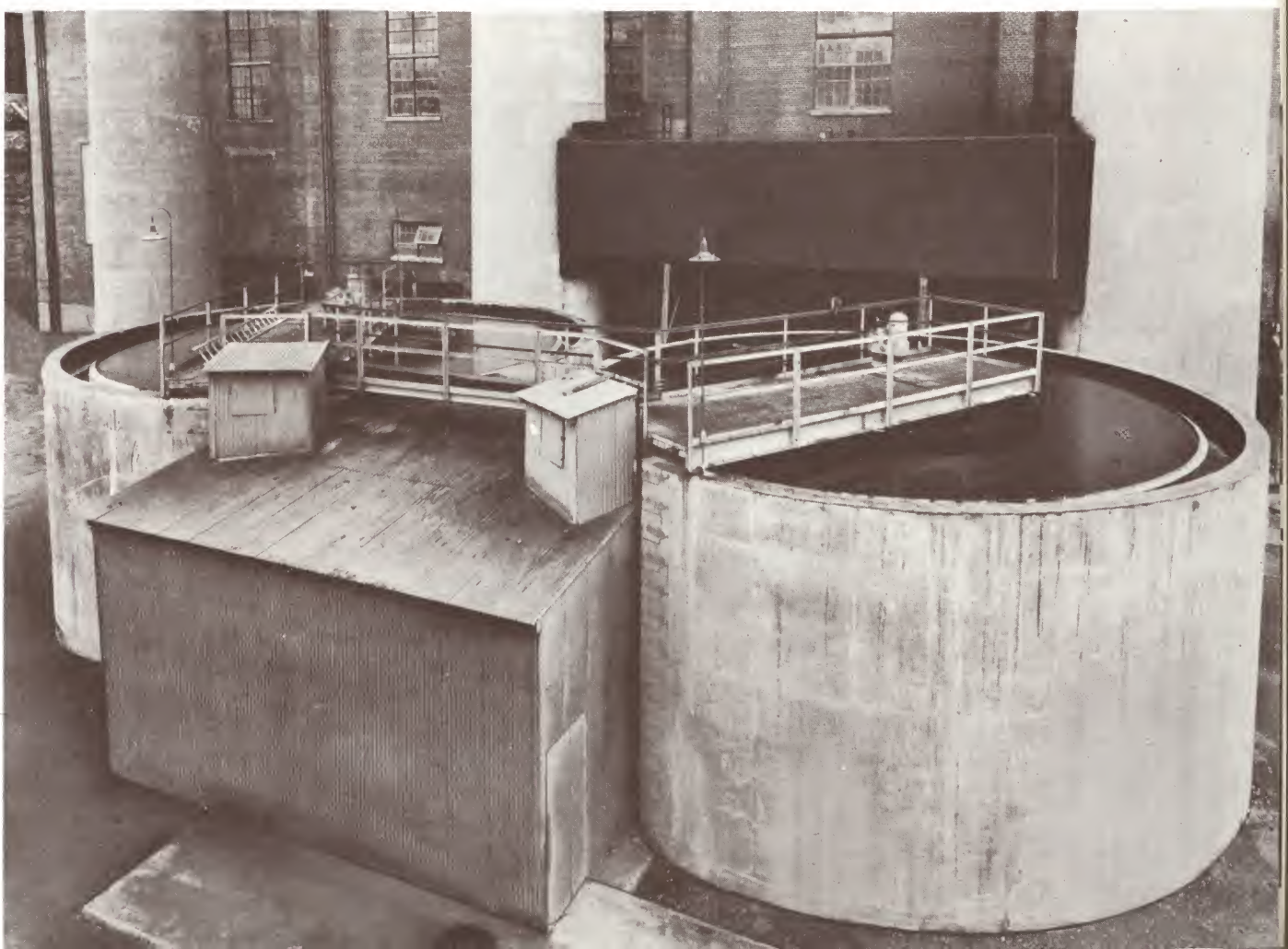
The "ACCELATOR" treating plant provides the ideal means of accomplishing these objectives on many waters. As a clarifier, it removes turbidity and suspended and organic matter; as a softener, it reduces calcium carbonate and iron (the principal contributors to scale formation) to low limits; and, in many instances, it produces a treated water of sufficiently high pH value to minimize or eliminate corrosion difficulties.

Also the characteristics of the water treated in an "ACCELATOR" unit frequently make it desirable for other plant uses—as for process, house service in public utility plants and, with supplementary treatment, for boiler and evaporator make-up.

TYPICAL INSTALLATIONS

Name of company	gpm
• *Wheeling Steel Corp.—Yorkville, O.*	5,000
• *Utah Copper Co.—Magna, Utah*	4,000
• *Public Service Co. of Indiana—W. Terre Haute, Ind.*	1,000
• *Utah Oil Refining Co.—Salt Lake City, Utah*	1,200
• *West Texas Utility Co.—San Angelo, Texas*	900
• *West Texas Utilities Co.—Girvin, Texas*	700
• *West Texas Utilities Co.—Abilene, Texas*	700
• *Braddock Light & Power Co.—Alexandria, Virginia*	875
• *Public Service Co. of Indiana—Noblesville, Indiana*	500
• *Public Service Co. of Indiana—Edwardsport, Indiana*	350
• *El Paso Natural Gas Co.—Jal, New Mexico*	300
• *El Paso Natural Gas Co.—Eunice, New Mexico*	250
• *Hanlon Gasoline Co.—Breckenridge, Texas*	250

Figure 8. "ACCELATOR" units provide properly treated cooling water for the central power station of the Utah Copper Co., Magna, Utah.



Pulp & Paper Industry

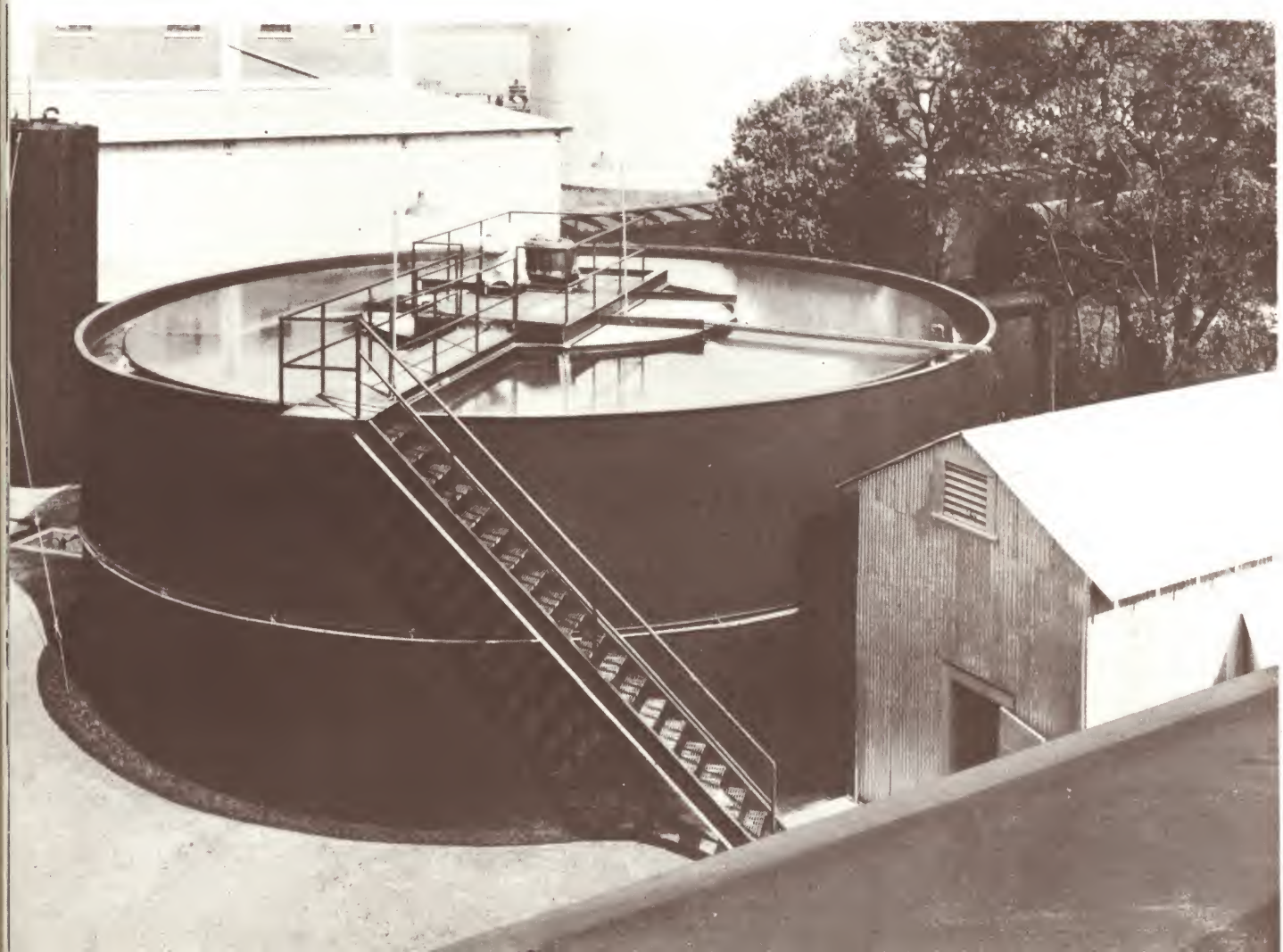
Since pulp and paper quality are significantly influenced by the quality of the water used in their manufacture, the "ACCELATOR" treating plant has been the choice of many pulp and paper mills for improving the quality of the mill supply by clarification, color and iron removal, and partial or complete softening.

Because of its unique principles of operation, the "ACCELATOR" plant is capable of selectively removing calcium bicarbonate from the water treated in it without precipitating magnesium hardness as magnesium hydrate. In consequence, the sludge produced is practically pure calcium carbonate. Thus, where the reburning of sludge produced in the causticizing process is practiced, the sludge produced in the "ACCELATOR" unit may also be reburned to provide lime required for the causticizing operations. The "ACCELATOR" treating plant produces calcium carbonate sludge in an amount nearly twice that of the lime used for softening.

TYPICAL INSTALLATIONS

Name of company	gpm
• *International Paper Co.—Natchez, Miss.*	42,000
• *Brunswick Pulp & Paper Co.—Brunswick, Georgia*	14,000
• *Potlatch Forests, Inc.—Lewiston, Idaho*	12,500
• *International Paper Co.—Livermore Falls, Maine*	11,200
• *St. Mary's Kraft—St. Mary's, Georgia*	10,500
• *Charmin Paper Co.—Green Bay, Wisconsin*	8,750
• *Scott Paper Co.—Chester, Pennsylvania*	8,400
• *North Carolina Pulp Co.—Plymouth, North Carolina*	8,400
• *St. Mary's Kraft—St. Mary's, Georgia*	7,000
• *New York & Pennsylvania Co.—Johnsonburg, Pa.*	7,000
• *New York & Pennsylvania Co.—Johnsonburg, Pa.*	7,000
• *Consolidated Water Power & Paper Co.—Wisconsin Rapids, Wisconsin*	7,000
• *National Container Corp.—Jacksonville, Florida*	7,000
• *Kimberly Clark Co.—Kimberly, Wisconsin*	7,000
• *Northwest Paper Co.—Cloquet, Minnesota*	3,500
• *Northwest Paper Co.—Cloquet, Minnesota*	2,100
• *International Paper Co.—Panama City, Florida*	2,000
• *International Paper Co.—Georgetown, South Carolina*	900

Figure 9. A steel tank "ACCELATOR" treating plant provides softened process water at the National Container Corp,. Jacksonville, Florida.



Oil Industry Use

In addition to its use for treating boiler feed and cooling water make-up for gas and gasoline plants, the "ACCELATOR" treating plant has been widely accepted as a means for treating water and brine for flooding purposes for the secondary recovery of oil from underground formations and for the treatment of oil field brines for disposal purposes.

For these applications, softening is unnecessary, but highly efficient clarification and chemical stabilization is a "must" if clogging of the formation into which the water or brine is injected is to be prevented, and if deposit or corrosion in distribution and input piping are to be minimized.

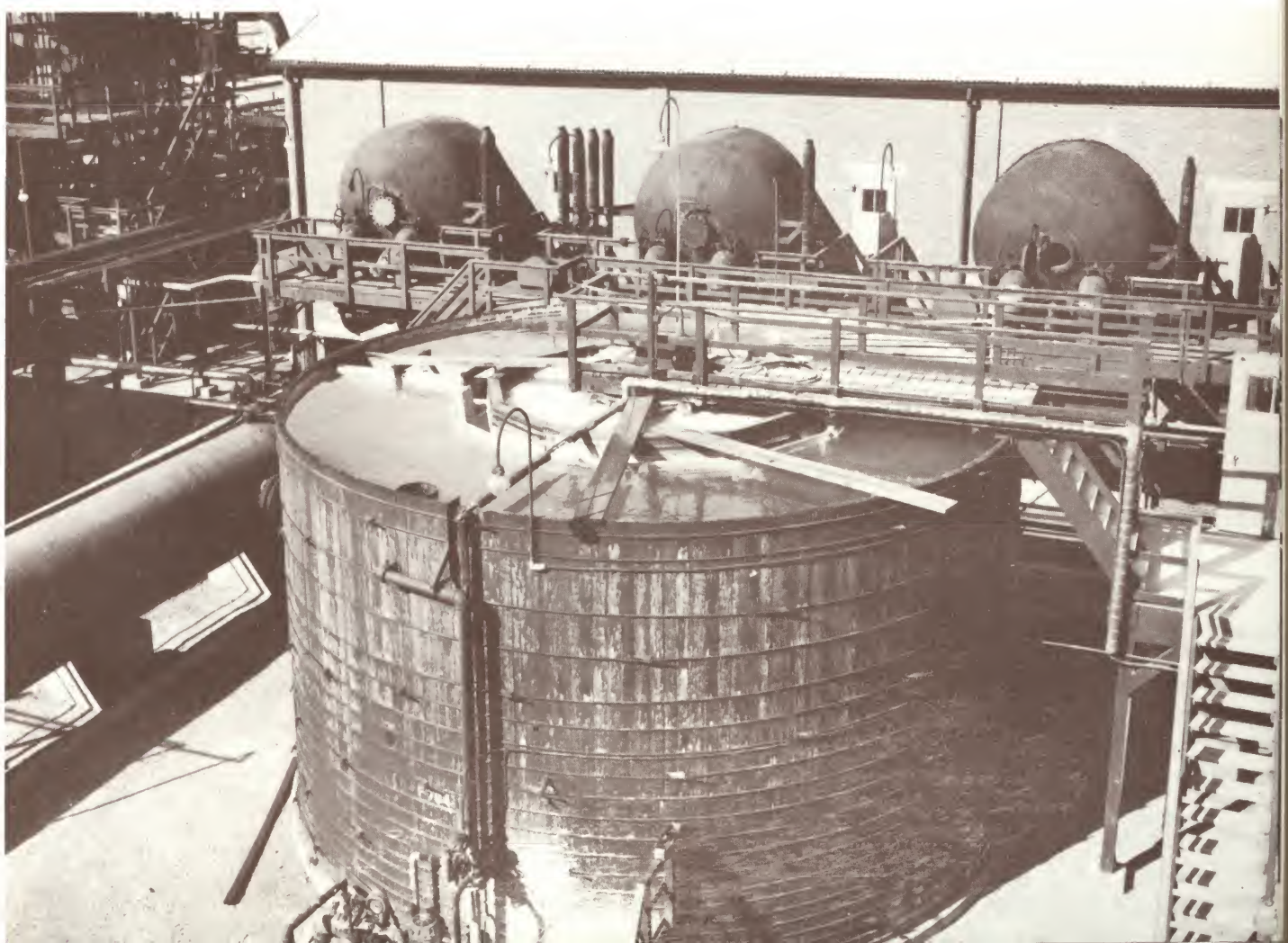
By the use of the "ACCELATOR" unit, using lime and a coagulant – ordinarily – as treating reagents, with aeration when required prior to treatment, iron present in the water or brine is reduced to a trace, and turbidity and suspended matter are completely removed. In addition, a chemically stable finished water is produced which will form little or no deposit in the distribution piping or input formation.

By the use of the "ACCELATOR" unit, all of the necessary treatment steps are provided in a compact plant requiring small space and the minimum attention for operation and chemical control.

TYPICAL INSTALLATIONS

Name of company	gpm
• *Phillips Petroleum Co.—Borger, Texas*	7,000
• *Texas Company—Salem, Illinois*	5,200
• *International Petroleum Co.—Talara, Peru*	2,450
• *Creole Petroleum Corp.—Jusepin, Venezuela*	1,750
• *Delaware Consolidated Oil Co.—Nowata, Okla.*	1,200
• *Pure Oil Co.—Delaware, Oklahoma*	600

Figure 10. Wood tank "ACCELATOR" treating plant provides softened water for the Utah Oil Refining Co., Salt Lake City, Utah.



Waste Treatment

Operating installations have proved conclusively the applicability and efficiency of the "ACCELATOR" plant to treatment of a wide range of industrial waste waters which lend themselves to clarification by chemical treatment or coagulation.

Waste sludge from water softening operations can be used to advantage in treatment of certain wastes. This material has considerable adsorptive capacity for colloidal solids and oil; its use often decreases chemical costs and improves the dewatering characteristics of sludges produced during waste treatment.

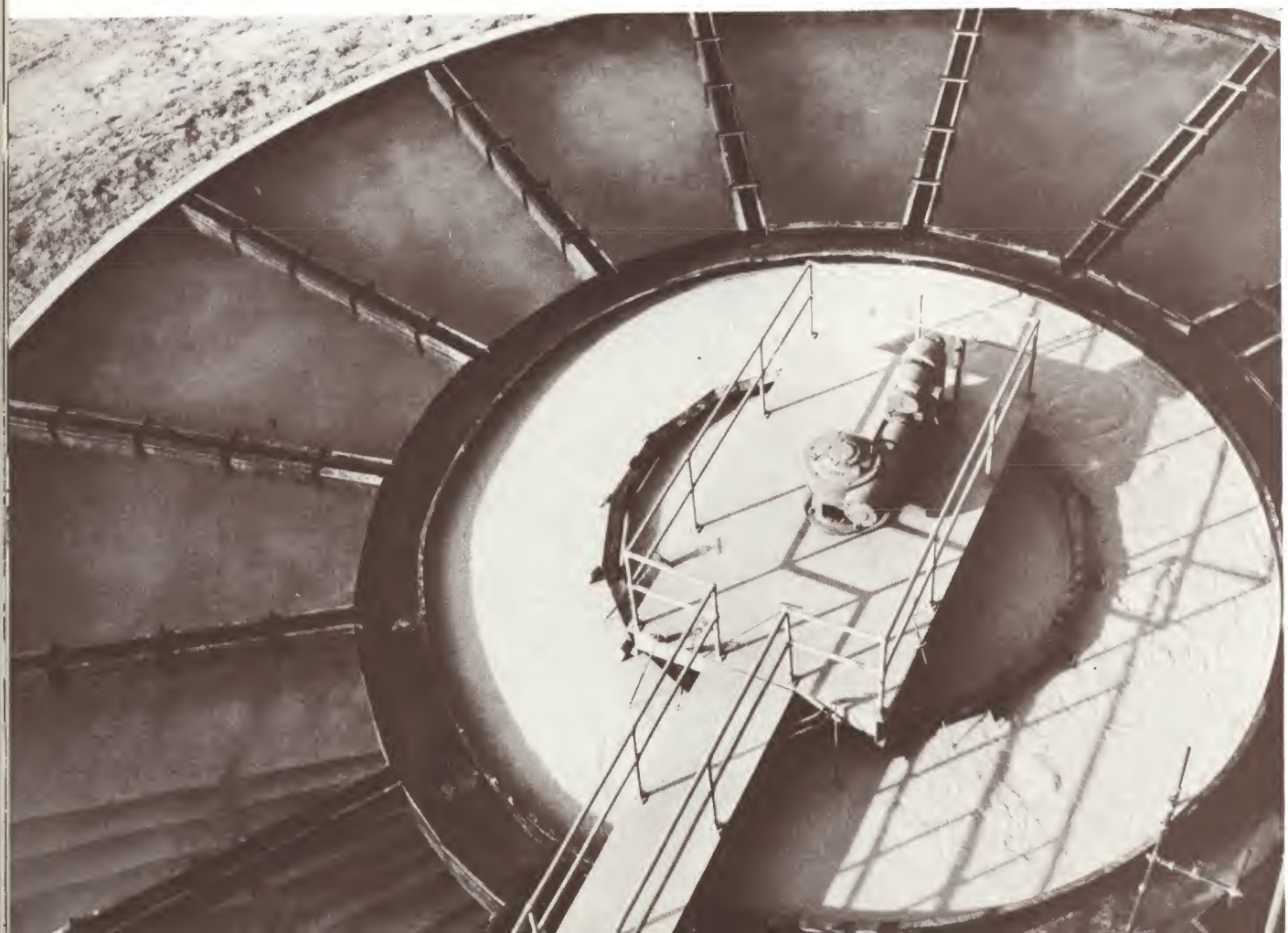
For those wastes characterized by large concentrations of light suspended solids, or which upon treatment produce voluminous sludges, INFILCO has developed the CYCLATOR® clarifier. This apparatus is described in Bulletin 850-B.

Effective high-rate activated sludge treatment of organic wastes is accomplished in the "AERO-ACCELATOR" plant. Bulletin 6510-A describes this equipment.

TYPICAL INSTALLATIONS

- *Rapid City Air Base—Weaver, South Dakota*
- *Rock Island Refining Co., Zionsville, Indiana*
- *Electric Auto Lite Co., Lockland, Ohio*
- *Chrysler Dodge Corporation, Indianapolis, Indiana*
- *Cosden Petroleum Corp., Big Springs, Texas*
- *Phillips Petroleum Co., Sweeney, Texas*
- *National Petro Chemicals Corp., Ficklin, Illinois*
- *General American Transportation Co., East Chicago, Illinois*
- *Clark Equipment Co., Jackson, Michigan*
- *General Petroleum Corp., Torrance, California*
- *General Petroleum Corp., Ferndale, Washington*
- *Atlantic Refining Co., Port Arthur, Texas*
- *Zippo Manufacturing Corp., Bradford, Pennsylvania*

Figure 11. This "ACCELATOR" clarifier in the disposal unit of National Petro-Chemicals Corporation, Tuscola, Illinois plant neutralizes or removes chemical and hydrocarbon wastes.



Brine Treatment

The development of the "ACCELATOR" treating plant for softening saturated brine has been of benefit to alkali and chlorine manufacturers for treating electrolytic cell feed.

It is essential that calcium and magnesium in the feed to diaphragm cells be reduced to a minimum to prevent clogging of the cell diaphragms. In mercury cell feed, the magnesium should be maintained below one part per million to avoid magnesium amalgam formation and also the formation of magnesium hydroxide sludge on the mercury surface.

In the synthetic rubber industry, brine used for coagulation must approach "zero" hardness to avoid insoluble soap formation.

Slurry contact is extremely important in reducing supersaturation in saturated brine. In addition, slurry recirculation in the "ACCELATOR" treating plant causes the formation of denser sludge particles which settle rapidly, even in a high specific gravity brine.

The performance of the "ACCELATOR" unit in treating saturated brines has led to its widespread use by both industries—and suggests the application of the "ACCELATOR" treating plant to other process industries where liquid purification, or product recovery is involved.

TYPICAL INSTALLATIONS

ALKALI-CHLORINE PRODUCTION

- *Dow Chemical Co.—Sarnia, Ontario*
- *Dow Chemical Co.—Pittsburg, California*
- *Dow Chemical Co.—Midland, Michigan*
- *Columbia Southern Chemicals Corp.—Lake Charles, La.*
- *Columbia Southern Chemicals Corp.—Corpus Christi, Tex.*
- *Arvey Corporation—Memphis, Tennessee*
- *Marathon Paper Co.—Marathon, Ontario, Canada*
- *North Carolina Pulp Co.—Plymouth, North Carolina*
- *Dominion Alkali—Beauhornois, Quebec, Canada*

SYNTHETIC RUBBER PRODUCTION

- *U. S. Rubber Co.—Institute, West Virginia*
- *B. F. Goodrich Co.—Louisville, Kentucky*
- *B. F. Goodrich Co.—Port Neches, Texas*
- *B. F. Goodrich Co.—Borger, Texas*
- *Goodyear Tire & Rubber Co.—Baytown, Texas*
- *Goodyear Tire & Rubber Co.—Houston, Texas*
- *Goodyear Tire & Rubber Co.—Los Angeles, California*
- *Firestone Tire & Rubber Co.—Akron, Ohio*
- *Firestone Tire & Rubber Co.—Lake Charles, Louisiana*
- *Firestone Tire & Rubber Co.—Baton Rouge, Louisiana*

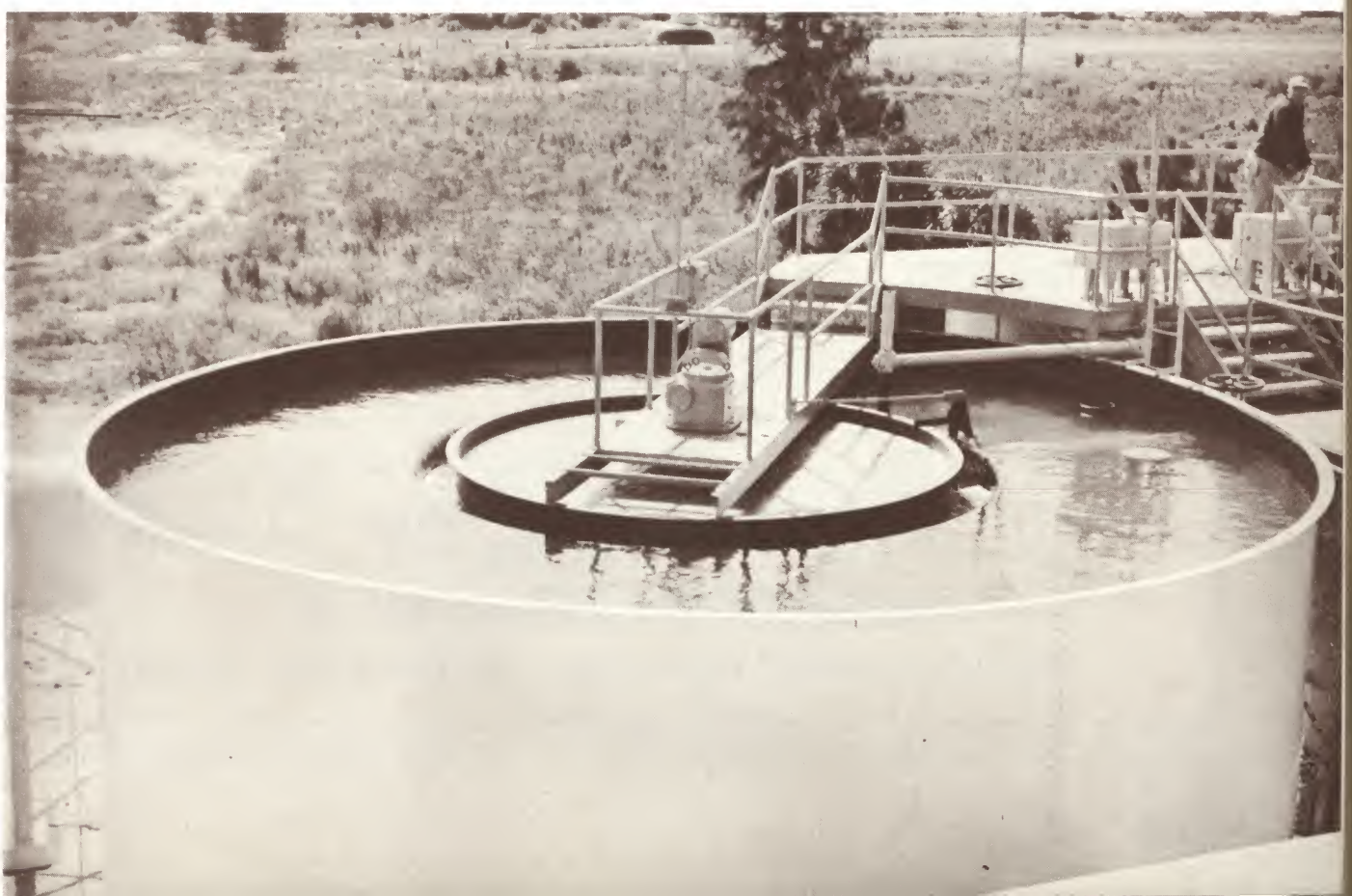
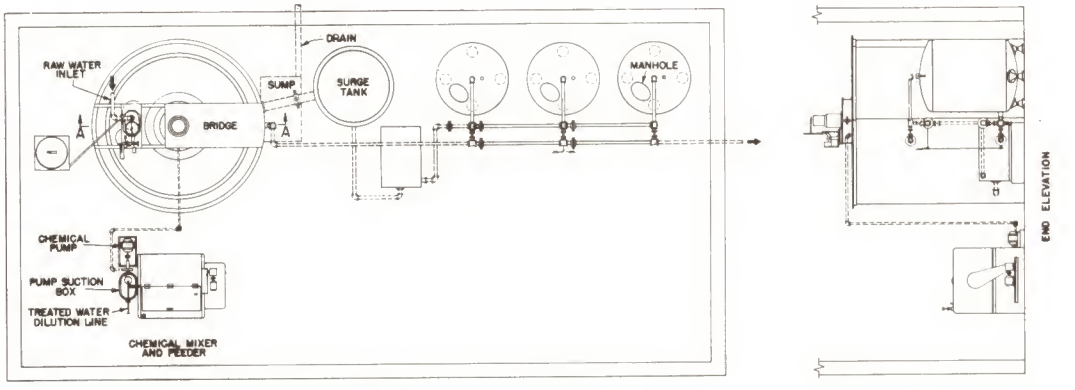


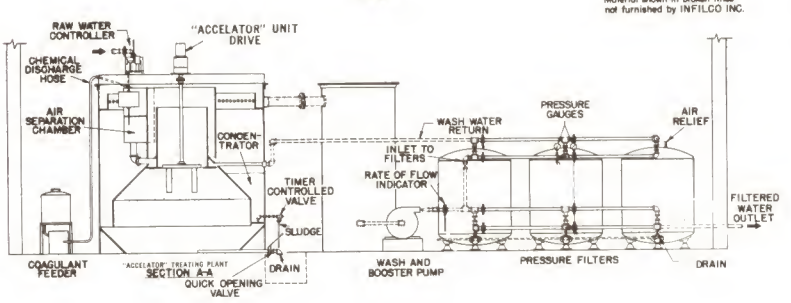
Figure 12. "ACCELATOR" softener at Vero Beach, Florida.

Table of Suggested
Applications

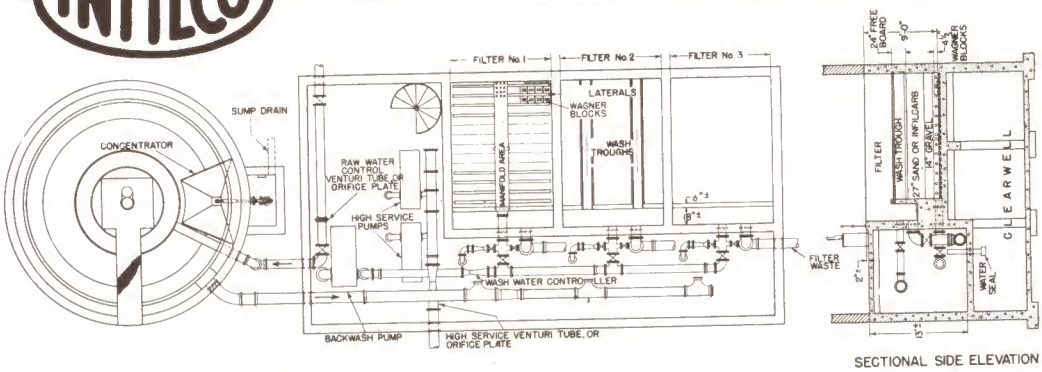
WATER END-USE	SOFTENING	CLARIFICATION	STABILIZATION	ALKALINITY REDUCTION	REMOVAL OF ORGANIC MATTER	REMOVAL OF TASTE AND ODOR	COLOR REMOVAL	IRON REMOVAL	SILICA REMOVAL	NEUTRALIZATION
	POSSIBLE TREATMENT REQUIREMENTS									
MUNICIPAL SUPPLIES	X	X		X	X	X	X	X		
PULP MILLS	X	X		X	X		X	X		
PAPER MILLS	X	X		X	X		X	X		
SOFT DRINKS (BEVERAGE INDUSTRY)		X		X	X	X	X	X		
COOLING WATER	X	X	X	X	X			X		
BOILER FEED	X	X		X	X		X	X	X	
RAILROADS	X	X					X			
TEXTILE PLANTS	X	X			X		X	X		
CANNERIES		X		X	X	X		X		
BREWERIES		X		X	X	X	X	X		
OIL FIELD FLOODING		X	X		X		X	X		
OIL FIELD BRINE DISPOSAL		X	X		X		X	X		
TRADE WASTES DISPOSAL AND REUSE		X	X		X		X			X

INFILCO



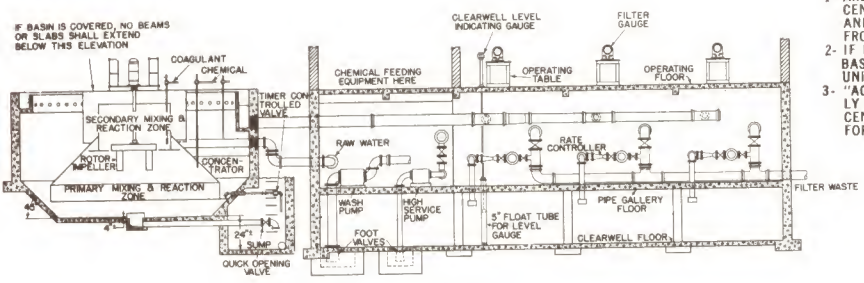


Typical Treating Plant Layout using "ACCELATOR" unit with steel tank and Pressure Filters



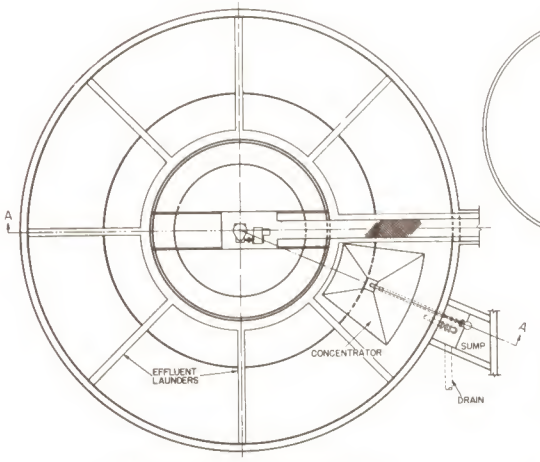
PLAN AT PIPE GALLERY

SECTIONAL SIDE ELEVATION

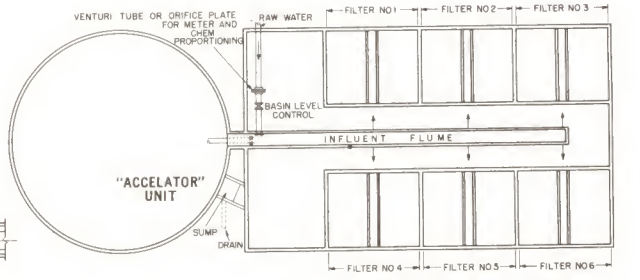


SECTIONAL FRONT ELEVATION

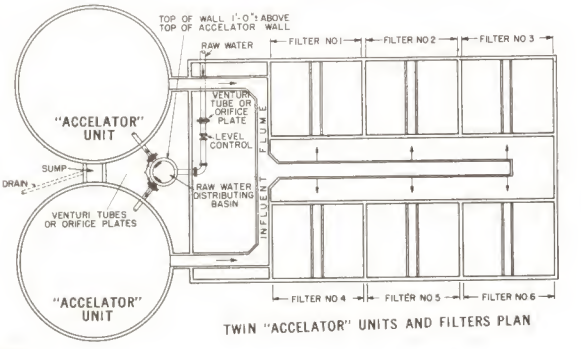
NOTES:
1- AREA & NUMBER OF ACCELATOR CONCENTRATORS DEPENDS ON QUANTITY AND TYPE OF SOLIDS TO BE REMOVED FROM WATER.
2- IF FOR SOFTENING, A RECARBONATING BASIN IS TO BE BETWEEN "ACCELATOR" UNIT AND FILTERS.
3- "ACCELATOR" ACCESS WALKWAY ACTUALLY IS LOCATED IMMEDIATELY OVER CONCENTRATORS. IT IS SHOWN AS ABOVE FOR CLARITY.



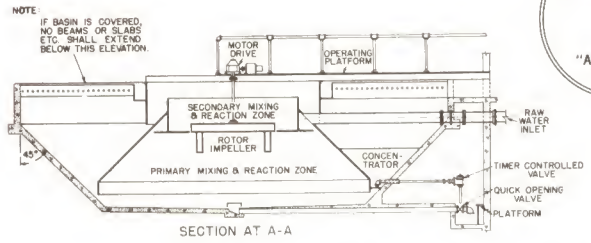
PLAN OF "ACCELATOR" TREATING PLANT



SINGLE "ACCELATOR" UNIT AND FILTERS



TWIN "ACCELATOR" UNITS AND FILTERS PLAN



SECTION AT A-A

IF FOR SOFTENING, A RECARBONATING BASIN IS TO BE BETWEEN "ACCELATOR" UNIT AND FILTER

Typical Treating Plant Layouts using "ACCELATOR" units with Concrete Basins and Gravity Filters

Suggested Specifications

SOLIDS CONTACT TREATING UNIT(S):

There shall be furnished the equipment for installation in _____reaction basin(s) as shown on the plans. (The)(Each) unit shall be capable of treating a maximum of_____gallons per minute to a minimum of 10% of maximum. The reaction basins shall conform to the detailed dimensions supplied by the manufacturer.

The manufacturer shall furnish all equipment required within the walls of the basin and above the basin floor and shall furnish all connections through the walls and sludge blow-offs and drain valves in the sump(s). Fill for slopes, and hopper bottoms of sludge concentrators will be furnished by the (purchaser)(general contractor) to detailed dimensions supplied by the manufacturer.

The manufacturer shall furnish all steel platework, and structural members for forming and supporting the raw water inlet distributing duct, primary and secondary reaction chambers, separation chamber, launders, and drive support with walkway. The manufacturer shall furnish variable speed motorized drive and starter, rotor-impeller with shaft, coupling, etc., for mixing and recirculation of raw water and slurry, inlet and sludge draw-off piping, concentrator(s), hopper gates, timer-controlled concentrator discharge valves, and main drain valve and/or side drain valve with extension stems and stands. Electric current available will be_____ volt, 3 phase, 60 cycle alternating current.

Raw water and treating chemcials shall be combined in the primary mixing and reaction chamber so that reaction shall take place in the presence of recirculating slurry.

In the primary mixing and reaction chamber the turnover shall be from ten to fifteen times the throughput of the treating unit. There shall be recirculation from the primary mixing and reaction chamber up through the secondary reaction chamber, thence outward and downward through the solids separation zone to the primary mixing and reaction chamber, the recirculating rate being at least three times the throughput. In this way there shall be formed a slurry pool in the lower portion of the outer, or separation, chamber with a clear water zone above. Separation of solids from the water shall take place near the surface of this slurry pool, which shall remain at substantially the same elevation for all treating rates.

A sufficient number and size of concentrators shall be provided to remove the excess solids and maintain correct slurry concentration. These concentrators shall be hopper-like compartments near the bottom of the separation chamber, so designed that solids from the recirculating slurry will settle out as they pass over the concentrators, in which they are thickened and discharged to the sump. Means shall be provided for automatically proportioning the discharge from the concentrators to the flow of raw water into the treating unit.

This equipment shall not require or use any underwater bearings or stuffing boxes for the drive shaft.

The manufacturer of the treating equipment quoted on and manufacture of the type of equipment proposed and must be able to refer to at least 25 similar installations, at least half of which have been in operation for 5 years or more.

Figure 13. Modern, municipal water conditioning plant at Gainesville, Florida using the "ACCELATOR" unit and other performance-proved INFILCO equipment.

Bibliography

Behrman, A. S., "Water Purification to Meet Paper Mill Requirements", Tech. Assoc. Papers, 1937

Behrman, A. S., and Green, W. H., "Accelerated Lime-Soda Water Softening", Industrial and Engineering Chemistry, February, 1939

McBride, G. A., "Progress in Lime-Soda Water Softening", Journal American Water Works Association, March. 1939

Rady, J. J., 'A Report on the Georgetown, Texas Accelator Water Softening Plant", Southwest Water Works Journal, April, 1939

Powell, S. T., et al, "Complex Silicate Scales in High-Pressure Boilers—Their Occurrence and Correction", Combustion, August, 1939

Spafford, H. A., and Klassen, C. W., "Illinois' Experience in Lime Softening with Short-Time Upward-Flow Clarification", Journal American Water Works Association, October, 1939

"Special Process and Boiler Feed Water Treatment", The Paper Mill and Wood Pulp News, June 15, 1940

Lammers, F. J., "Recent Developments in Water Treatment", The Paper Mill and Wood Pulp News, August 10, 1940

Gibson, W. R., and Sawyer, B. W., "Accelerated Water Clarification—the Accelator", Pacific Pulp and Paper Industry, June, 1941

"Handbook of Feedwater Treatment", Power, December, 1941

Richter, R. C., and Lammers, F. J., "Water Treatment at National Container Paper Mills", Tech. Assoc. Papers, 1941

Frazer, H. W., "Calcium Bicarbonate Removal from Water in Sulphate Mills", Tech. Assoc. Papers, 1942

Kahn, J. M., "Color Removal with the Accelator", Journal American Water Works Association, May, 1943

Embshoff, A. C., "Operating Experiences with Accelator Softeners and Clarifiers", Proceedings Fourth Annual Water Conference, Engineer's Society of Western Pennsylvania, November, 1943

Embshoff, A. C., "Paper Mill Operating Experience with Accelator Softeners and Clarifiers", Tech. Assoc. Papers, 1943

Embshoff, A. C., "Treatment of Paper Mill Wastes for Recovery of Fibre, Filler and Water", Tappi, February, 1944

Lammers, H. B., and Sheen, R. T., "Treating Process Water for Wright Aeronautical", Power Plant Engineering, July, 1944

Squire, A. Bradford, "Wartime Reconstruction of Water Treatment Works at Williamstown, N. Y.", Water Works & Sewerage, October, 1944

Ebaugh, G. M., "Wartime Water Works Remodeling for Permanence", The American City, December. 1944

Noreus, R. E., "The Use of Activated Silica in the Coagulation of Highly Colored Water", Tappi Papers, June, 1945

Embshoff, A. C., "Water Softening Time Shortened", Power Plant Engineering, June, 1946

McBride, G. A., "Metodo Moderno para Tratamiento de Aguas", Dyna, November, 1947

Embshoff, A. C., "How Some Troublesome Waste Water Problems Were Solved", Proceedings Eighth Annual Water Conference, Engineers Society of Western Pennsylvania, November, 1947

Feller, E. W., "Fundamentals of Feedwater Treatment", Power, December, 1947

Kalinske, A. A., "Settling Characteristics of Suspensions in Water Treatment Processes", Journal American Water Works Association, February, 1948

Kalinske, A. A., "Wastes Treatment in Pilot Plant Using Water-Softening Sludge", Sewage Works Engineering, September, 1948

Kominek, E. G., "Treatment of Plating Wastes", Metal Finishing, March, 1949

Kominek, E. G., "Accelerated Waste Treatment Methods", Chemical Engineering Progress, July, 1949

Kominek, E. G., "Flocculation and Sedimentation of Wastes", Sewage and Industrial Wastes Engineering, June, 1950

"Treatment of Tank Car Wastes Replaces Lagooning to Keep Step With Anticipated Pollution Law", Chemical Processing, September, 1951

"Industrial Waste Treatment", Industry and Power, June, 1951

Austin, R. J., and Vause, E. H., "Chemical Flocculation of Refinery Waste Water", Proceedings of the Sixth Industrial Waste Conference, Purdue Engineering Extension Department, February, 1951

Bass, J. H., and Evans, R. R., "Sedimentation and Flocculation Equipment for Treatment of Industrial Wastes", Sewage and Industrial Wastes, December, 1951

ACCELATOR* Treating Plants
ACCELAPAK Treating Plants
ACCELATOR* HOT-FLOW* Softeners
ACCELO-BIOX* Liquid Treating Plants
ACCELO* Filters
ACCELO HI-CAP* Filter Underdrain Tile
Acid Feeders
Aerators
AERO-ACCELATOR Liquid Treating Plants
AERO-CYCLATOR Liquid Treating Plants
AERO-SPRAY Nozzles
Alkalinity Reduction Plants
ANEX* Exchangers
ANEXER* Ion Exchange Plants
Automatic Controls
BIOSORPTION* Activated Sludge Plants
Boiler Feed Treatment Plants
BOR-EX* Purifiers
C.-A.-P. SYSTEM* Instruments
CATEX* Exchangers
CATEXER* Ion Exchange Plants
Chemical Feeders and Proportioners
Clarifiers
Coagulant Feeders
Coagulators
COLAFLEX* Diffusers
Color Removal Plants
CRYSTALITE* Zeolites
CYCLATOR* Clarification Plants
Dechlorinating Plants
Deionizers
Depth Gauges
Digester Mixing & Heating Equipment
Filter Plant Equipment
Filter Underdrain Systems
Floating Covers
Flotation Equipment
FLUOREX* Purifiers
Gas Dispersers
Gauges, Indicating and Recording
Grease and Grit Removal Systems
GRIDUCTOR* Comminutors
HOT-FLOW* Softeners
Hydraulic Controls and Switches
HYDRODARCO PURIFIERS
INFILCARB Anthracite
INTERNATIONAL* Disk Filters
Ion Exchangers
IONEXER Demineralizers
Iron Removal Plants
JBAS Treating Plants
Lime Slakers and Feeders
Lime-Soda Water Softeners
Liquid Level Controls and Gauges
Loss of Head Gauges
Manometers
Mixing Equipment
MULTICONE Aerators
NEUSOL* Feeders
Odor Removal Plants
Oil Removal Plants
Operating Tables
Phosphate Feeders and Softeners
Pressure Filters
Rate of Flow Controllers and Gauges
Recarbonators
ROBOTEL Indicators
ROBOTROL* Automatic Controls
ROTAGRATOR* Screen and Comminutor
Rotary Distributors
Sampling Tables
Sand Filters
SEDIFLOTOR* Clarifiers
Sewage Treatment Plants
SILVER STREAM Filters
STELLAR* Filters
Sterilizing Equipment
Swimming Pool Systems
Taste Removal Plants
Thickeners
Tray Filters
Venturi Tubes
VERDITE Zeolites
VORTI Mixers
VORTI-FLOC* Coagulators
VORTI-MIX* Aerators and Circulators
WAGNER Underdrains
Wash Water Controllers
Waste Acid Neutralizing Plants
Waste Water Treating & Recovery Systems
White Water Treating Plants
Zeolite Water Softeners

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